

Docket #72199

AUTOMATIC DRIVER DEVICE AND JOINING PROCESS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a United States National Phase application of International Application PCT/EP2004/014023

SECFICATION

5 Automatic Screwdriver Device and Joining Process

and claims the benefit of priority under 35 U.S.C. § 119 of German Utility Model 203 19 310.5 filed December 12, 2003, the entire contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention pertains to an automatic screwdriver, screw, bolt or nut driver device and a joining process with the features in the preamble of the principal process claim and the principal device claim:

5 . The term driver or drive tool refers to a device that is used to drive either a nut or a bolt.
Driving refers to a bolting or screwing action.

BACKGROUND OF THE INVENTION

[0003] Such an automatic screwdriver device for screwing together body parts by means of an inserted spindle carrier is known from DE 37 29 084 A1. ~~It comprises~~ The device is comprised of a basic carrier and two automatic screwing tools, which are mounted thereon such that they can be displaced along two axes and screwingly mesh (rotate to run/bolt) with the spindle extensions located at the spindle carrier. The adjusting means used for the motion along two axes comprises a cross arm each, which is mounted in the circular rail-like frame of the basic carrier in a longitudinally displaceable manner. An individual screwing driver tools is mounted at each cross arm by means of a running carriage in an axially displaceable manner. This biaxial adjusting means has a shape similar to that of a crane running carriage. The design limits the number and the possibilities of degrees of freedom of motion of the screwing driving tools, which must be adjusted individually. The consequence of this is that each screwing driving tool must perform a plurality of screwing operations at different points and must travel over corresponding displacement paths for this. This is disadvantageous for the cycle time.

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SUMMARY OF THE INVENTION

[0004] The object of the present invention is to ~~show a better~~improve the automatic ~~screwing~~driving technique.

[0005] The present invention ~~accomplishes this object with the features in the principal~~
5 ~~process claim and in the principal device claim. The screwing technique being claimed~~presents a
driving technique that has the advantage that the number of ~~screwing~~driving tools can be changed
and especially increased as needed. Furthermore, the possibilities of motion and adjustment of the
~~screwing~~driving tools improve. A plurality of ~~screwing~~driving tools can be integrated in
~~screwdriver~~to driving groups on a carriage unit ~~and adjusted. Adjustment can be made to as a~~
10 driving group, and adjustment within the ~~screwdriver~~driving group is also possible, if needed, due
to the mutual adjustability of the carriage steps, e.g., their ability to be telescoped.

[0006] Furthermore, the ~~screwdriver~~ device offers the advantage that the ~~screwing~~driving
tools may have individual additional transverse adjustments in order to be able to be adjusted
along two or more axes in the principal plane of the basic carrier. Due to this ~~splitting~~grouping,
15 the carriage units and the transverse adjustments require ~~little~~less space, which offers, on the other
hand, the possibility of accommodating a ~~plurality~~increasing number of ~~screwing~~driving tools in
any desired position and with ~~large~~wide ranges of motion on ~~the~~a basic carrier.

[0007] _____ The individual carriage unit and the other adjusting means have a smaller width and length than the basic carrier. This makes it possible to accommodate a plurality of carriage units next to one another in the longitudinally directed x axis and/or the transversely directed y axis of the basic carrier. As a result, the screwingdriving tools can be adjusted in relation to one another along one axis or along a plurality of axes in the longitudinal and transverse directions without the risk of collision. This is not possible in the prior-art screwdriver-device designs of nut or bolt driver tools with the cross arm.

[0008] _____ Due to the freely selectable equipment with screwingdriving tools and the increased mobilities, the screwdriverdriver device being claimed according to the invention offers great flexibility in set-up and adjustment, but also in case of retrofitting to different components, especially vehicle bodies, and spindle carriers that possibly belong to them. This is advantageous above all during the final assembly of motor vehicles, because models frequently change here, and even the body types, e.g., limousine and station wagon, etc., may frequently change within the same model. Variations of the underbody and the screwingattachment points arise, e.g., due to different vehicle lengths, engine and transmission types, all-wheel drive, exhaust systems, sports or comfort type chassis, etc. Variations are also possible in the positions of the underbody-["der der Bodengruppe" in German original is a typo for "der Bodengruppe"-Tr.Ed.]. The screwdriverdriver device can now be adapted rapidly and simply.

[0009] _____ Due to the freely selectable number of screwingdriving tools, the number of

screwingdriving operations can be increased or the cycle time reduced as desired. This improves the utilization and the economy. In addition, it is possible to select and set any desired screwingdriving sequences due to the individual screwingdriving tools, which can be actuated independently from one another. This may be advantageous, e.g., to counter deformations or warping the components.

[0010] The screwdriverdriver device has, furthermore, the advantage that it can be withdrawn and extended with the basic carrier as a whole via a chassis and a preferably floor-bound guide at an assembly station, especially in a screwingbolt or nut driving station. This makes possible, especially in case of possible disturbances, a rapid changeover to a manual screwingdriving operation, in which case the screwdriverdriver device can be removed from the work area under the body or the spindle carrier in order to create space for workers with hand-held screwingdriving tools.

[0011] The screwdriverdriver device being claimed is preferably provided for screwingnut or bolt fastening/driving action on the underside of components or vehicle bodies. This may be an indirect screwingdriving function shown in the drawings with the insertion of a mobile spindle carrier with spindle extension. As an alternative, direct screwingdriving action is possible on the body. Possible height adjustments can be achieved in a simple and rather uncomplicated manner thanks to because of the design being claimed by means of bases at the screwingdriving tools. As a result, the screwingdriving tools themselves do not need to have excessively great paths of

adjustment in height.

[0012] In addition, the screwingdriving tools can have improved and enlarged freedoms of movement of their own for their screwingdriving units. Height and/or pivoting adjustments are possible now. The screwingdriving unit with the screwingdriving spindle and the spindle drive can be adjusted as a whole in relation to the bracket, which simplifies the design embodiment and the control. Due to the spindle drives and the different adjusting means being connected to a common control, fully automatic and highly flexible operation of the screwdriverdriver device is possible.

[0013] Furthermore, the screwdriverdriver device ~~being claimed~~ may have any design in height. In particular, despite the fact that the paths of adjustment are kept small, it is possible to obtain great overall heights due to the design of the bracket, which is advantageous for creating a sufficiently large free space for a manual screwingdriving activity in case of disturbance. In addition, an essentially identical interference contour can be obtained for all screwingdriving tools.

[0014] The screwdriverdriver device makes it, furthermore, possible to accommodate at the basic carrier a centering and lifting unit, which preferably has an additional vertical mobility for lifting out and introducing the components and the spindle carrier.

Other advantageous embodiments of the present invention are described in the subclaims:

The present invention is schematically shown in the drawings as an example. Specifically;

Figure 1 shows

[0015] The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying drawings and descriptive matter in which a preferred embodiment of the invention is illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] In the drawings:

[0017] Figure 1 is a simplified schematic side view of a screwing station with a vehicle body and with an automatic screwdriver device;

Figure 2 shows vehicle body to vehicle chassis fastening station utilizing an automatic driver device;

[0018] Figure 2 is a perspective view of the screwdriver device of Figure 1;

[0019] _____ Figure 3 shows a top view of a screwdriver device that differs in details;

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[0020] _____ Figure 4 shows a side view of a screwdriver device according to Figure 2;

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5 [0021] _____ Figures 5 through 7 ~~show different~~ is a views of a height-adjustable screwing tool,
and

Figures 8 through 10 show different views driver tools;

[0022] _____ Figure 6 is another view of a height-adjustable driver tools;

[0023] _____ Figure 7 is a perspective view of a height-adjustable driver tools;

10 [0024] _____ Figure 8 is a view of a pivotable and height-adjustable screwing tool.

The driver tools;

[0025] _____ Figure 9 is another view of a pivotable and height-adjustable driver tools; and

[0026] _____ Figure 10 is another view of a pivotable and height-adjustable driver tools.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0027] Referring to the drawings in particular, the present invention pertains to an automatic screwdriverdriver device (3) and, in addition, also to a screwingdriving station (1) equipped therewith.

[0028] Figure 1 shows a detail of an assembly station (1), which is designed as a screwingdriving station for one or more components (2) here. The component is preferably a vehicle body and parts thereof here. For example, chassis parts, especially a complete underbody with engine, axles, etc., are connected and screwedfastened or bolted to the body here. The body (2) or other components are brought into the screwingdriving station (1) with a conveyor, not shown, e.g., a C-type suspension gear and again removed after the assembly operation. The components (2) are mounted on suitable support and clamping devices in the correct position.

[0029] The chassis parts are brought into the assembly station (1) with a suitable aggregate carrier, which may also be a spindle carrier (35) with a plurality of spindle extensions, which are positioned corresponding to the screwingjoining points and are possibly mobile. As an alternative, the spindle carrier (35) may be arranged separately from the aggregate carrier. It may otherwise have any desired and suitable design, e.g., corresponding to DE-37 29 084 A1.

[0030] An automatic screwdriverdriver device (3), which is schematically shown in Figure

1 and in greater detail in Figures 2 through 10, is used for the assembly operation and for screwingdriving together the components. It comprises at least one basic carrier (8) and a plurality of screwingdriving tools (4, 5) with adjusting means (9, 16, 17, 24, 25).

[0031] The screwingdriving operation takes place via the intermediary of the spindle carrier (35) shown in Figure 1. The screwingdriving tools (4, 5) are fed to the spindle extensions and caused to mesh by their screwingdriving heads (22) with the screwdriver mounts located at the bottom. The spindle extensions have been equipped in advance with the corresponding fasteners, typically ~~screw means, especially~~ screws or nuts.

[0032] As an alternative, the screwingdriving operation may be carried out directly at the components (2) by means of the screwingdriving tools (4, 5) in an embodiment that is not shown, in which case the screwingdriving tools (4, 5) are equipped with the corresponding ~~screw means~~ fasteners, especially ~~typically~~ screws or nuts.

[0033] The screwdriverdriving device (4, 5) are present in a large numbers. Their number of single drive tools may correspond to the number of screwingfastening points on the component (2) and the number of spindle extensions. If different types of components are processed in a flexible mix, the number of screwingdriving tools (4, 5) may be selected according to the largest

occurring number of screwingfastening points and spindle extensions.

[0034]_____The ~~screwing and~~ joining process is carried out from below in the embodiment being shown with upright screwingdriving tools (4, 5) that can be fed in the z axis. This arrangement may also be different in an alternative.

5 [0035]_____The basic carrier (8) has a plate-like design and preferably has a parallelepipedic shape. It may be plate-like ~~and have with~~ a closed upper surface and optionally a closed lower surface. As an alternative, it may also be a lattice frame. The basic carrier (8) forms a plane load-bearing structure in this case.

[0036]_____The basic carrier (8) may be height-adjustable by means of a suitable lifting device
10 (not shown). The basic carrier (8) preferably has a chassis on the underside, with which it can be withdrawn and extended at the screwingdriving station (1). A suitable guide (30), e.g., a straight rail guide, may be present for this at the bottom (30) of the station. As an alternative, ~~rotary,~~
rotation mobility or ~~another other~~ suitable kinematics may also be present. The basic carrier (8)
15 can be moved as a result with a suitable drive between a working position at or under the components (2) and a withdrawn inoperative position while the working space at or under the components (2) is released.

[0037]_____ A plurality of screwingdriving tools (4, 5) are arranged individually or in screwdriverdriver/driving groups (6, 7) at the basic carrier (8). They are preferably located all on the top side of the basic carrier (8) and project vertically or obliquely upward. The design of the screwingdriving tools (4, 5) will be explained below on the basis of Figures 5 through 10.

5 [0038]_____ The screwingdriving tools (4, 5) are mounted in the main plane of the basic carrier (8) such that they are movable in one direction or two directions along the x and y axes by means of adjusting mechanism or means (9, 16, 17). The x axis extends here along the screwingdriving station (1) and the transfer line. At least one of the adjusting means is designed here as a multistep carriage unit (9) or as a carriage unit that can be telescoped or cascaded.

10 [0039]_____ The carriage unit (9) has a plurality of carriage steps (10, 11), which are movable in relation to one another along at least one linear axis relative to one another, can be controlled separately, are mounted next to one another and are preferably arranged one on top of another in the exemplary embodiment being shown. The respective upper carriage step (11) is supported now on the lower carriage step (10) and is movable in relation to this in the sense of a telescopic
15 or cascading arrangement. The first and lower carriage step (10) is mounted here movably on the top side of the basic carrier (8) in a suitable manner with a sliding or rolling bearing. The second carriage step (11) is mounted movably on the first carriage step (10) in a corresponding manner. Additional carriage steps can be arranged in the same manner in a cascade or in a telescopic arrangement one on top of another or optionally also next to one another. For example, two or

more carriage steps may be mounted on the first, lower carriage step (10), and these are now preferably movable separately and independently from one another.

[0040]_____The different carriage steps (10, 11) of the multistep carriage unit (9) are, e.g., all guided telescopically in the same direction. Mobility is present along one axis only, e.g., along the x axis, in the embodiment being shown. As an alternative, there also may be mobility along the y axis or even with oblique direction along the x axis and the y axis.

[0041]_____The carriage steps (10, 11) are formed by a preferably plate-shaped subcarrier (14, 15) with a corresponding controllable carriage drive (12, 13), e.g., an electric motor drive, and the aforementioned guiding sliding or rolling guide. One or more screwingdriving tools (4, 5) are arranged at the desired positions on the subcarriers (14, 15), which are preferably directed in parallel to the surface of the basic carrier (8). The height differences occurring between the carriage slides along the z axis between the screwingdriving tools (4, 5) can be compensated by accurately fitting bases (19) or the like. Fixed oblique positions can also be obtained with the bases (19).

[0042]_____The screwingdriving tools (4, 5) located on a multistep carriage unit (9) form a screwdriverdrive group (6, 7) each. This screwdriverdrive group (6, 7) is adjustable with the first carriage step (10) as a whole or together on the basic carrier (8) by the motion of the carriage.

By actuating the subsequent carriage steps (11), the screwingdriving tools (4, 5) can be adjusted relative to one another within the screwdriverdrive group (6, 7).

[0043] _____ The carriage steps (10, 11) are preferably mounted next to one another in one direction and, with a linear axis in the above-mentioned manner and are mutually adjustable. As an alternative, rotary mobility or linear mobility along another linear axis may also be present between the carriage steps (10, 11). More complex kinematics with a plurality of axes and direction superimpositions are also possible. This mutual mounting in different directions is called a cascade arrangement.

[0044] _____ The multistep carriage unit (9) has a smaller width and/or length than the basic carrier (8). It may be positioned on the basic carrier (8) at any desired and suitable point. Due to the small base, a plurality of carriage units (9) may be arranged next to one another on the basic carrier (8). In the embodiment being shown, two multistep carriage units (9) are arranged in the direction of the x axis at spaced locations one behind the other. As an alternative or in addition, a plurality of carriage units (9) may be arranged next to one another in the direction of the y axis.

[0045] _____ The screwdriverdriver device (3) may, moreover, have one or more screwingdriving tools (4, 5) or screwdriver groups on a one-step carriage or longitudinal adjusting

means (16). For example, two such adjusting means (16) are arranged between the multistep carriage units (9) in the embodiment being shown.

10046_____ To impart an additional mobility on the screwingdriving tools (4, 5), i.e., in the y direction, one or more additional adjusting means (17) may be present in the form of transverse
5 adjusting means. The screwingdriver tools (4, 5) preferably has a transverse adjusting means (17) of its own here. The transverse adjusting means is arranged in this case between the bracket (18) of the screwingdriving tools (4, 5) and the one-step or multistep carriage unit (9, 16). The transverse adjusting means has in turn a plate- or frame-like carrier for receiving the bracket (18) and a suitable, adjusting drive (26), e.g., an electric motor drive, along with mounting and guiding
10 for the carrier. As an alternative, a plurality of screwingdriving tools (4, 5) may have a common transverse adjusting means and be arranged on a common subcarrier ~~for this~~. ~~A kind of~~ cross slide is obtained ~~in a combination between with~~ the one-step or multistep carriage units (9, 16) ~~and combined with~~ the transverse adjusting mechanism or means (17).

10047_____ As is illustrated in Figure 3, the travel paths of the transverse adjusting means (17)
15 may also be directed obliquely. Moreover, the transverse adjusting means may have narrow bases or supports on the underside in order to make possible differences in height and a possible overlap in space with different carriage steps (10, 11).

5 [0048] Figure 3 shows this arrangement at the left-hand screwdriverdriving group (6) with the upper and lower marginal screwingdriving tools (4), which are mounted with narrow supports on the lower carriage step (10) and project in height over the second carriage step (11), their transverse adjusting means being located above the second carriage step (11) and overlapping same in the top view.

10 [0049] Figures 5 through 7 as well as Figures 8 through 10 show two variants of screwingdriving tools (4, 5) in detail and in different views. The first embodiment according to Figures 5 through 7 shows a screwingdriving tools (4) that is adjustable in height along the z axis. It comprises, e.g., an upright, column-like bracket (18), which is arranged on one of the adjusting means (9, 16, 17) or directly on the basic carrier (8). The screwingdriving unit (20) is mounted movably at the bracket (18) by means of a height adjusting means (24).

15 [0050] The screwingdriving unit (20) comprises, e.g., a screwingdriving spindle (21), which carries at its upper end a screwingdriving head (22), e.g., a screwdriver nut. A spindle drive (23) is arranged at the lower end of the screwingdriving spindle (21). The parts are connected to one another to form the screwingdriving unit (20) and are moved up and down as a unit by means of the height adjusting means (24). An adjusting guide (32), here a sliding guide, is arranged here at the bracket (18) with an adjusting drive (26), e.g., a cylinder or the like. The screwingdriving spindle (21) has a fixed length in this embodiment and is moved up and down

together with the spindle drive (23) being carried. Another direction of motion is also possible in case of oblique direction of the sliding guide (32).

10051 Figures 8 through 10 show a second variant with a pivotable screwingdriving tools (5). Both the above-described height adjusting means (24) and a pivoting adjusting means (25) are present here. As an alternative, there may also be a pivoting adjusting means (25) only. The height adjusting means (24) is mounted at the pivoting adjusting means (25) in the embodiment being shown and is rotated or pivoted together with same. An adjusting drive (26), e.g., a controllable cylinder, is arranged for this at the bracket (18), the adjusting drive (26) acting on the sliding guide (32), which is mounted at the bracket (18) pivotably about a horizontal axis, via a sliding guide (33), e.g., a crank. As an alternative, the adjusting drive (26) may have an electric stepping motor or another drive, which can be positioned multiply and accurately, in order to make it possible to precisely set any desired, different pivot angle of the screwingdriving unit (20) with the pivoting adjusting mechanism or means (25).

10052 The adjusting means (9, 16, 17, 25) shown in Figures 2 through 4 offer various kinematic adjustment and motion possibilities for adaptation to different components or bodies (2). On the one hand, the screwingdriving tools (4, 5) integrated in one screwdriver group (6, 7) are mounted movably as a group or as a whole at the basic carrier (8) by means of an adjusting means (9). They are located together on a plate- or frame-like subcarrier (14, 15) and are moved with same, e.g., on the first carriage step (10). On the other hand, the screwingdriving tools (4,

5) can be additionally mounted movably and adjustably relative to one another within the screwdriver group (6, 7) by means of at least one auxiliary axis. Different possibilities are available for this in the exemplary embodiments.

[0053]_____ This additional mobility may be given, e.g., by the relative motion of the carriage steps (10, 11). For example, a plurality of screwingdriving tools (4, 5), which form subgroups, are located on the subcarriers (14, 15) of the carriage steps (10, 11). The subgroups are adjusted in relation to one another by the motion of the carriage.

[0054]_____ As an alternative or in addition, relative motions of the screwingdriving tools (4, 5) may take place within the screwdriver group (6, 7) or even within one or more of the above-mentioned subgroups due to the one or more transverse adjusting means (17). As an alternative or in addition, relative motion of the screwingdriving tools (4, 5) is possible due to the pivoting adjusting means (25).

[0055]_____ The adjusting means (9, 16, 17) mounted on the surface of the basic carrier (8), especially the multistep carriage unit (9), make it, furthermore, possible to position the screwingdriving tools (4, 5) outside the edge of the carrier. The elimination of binding the position to the carrier geometry offers maximum flexibility and permits simple and inexpensive adaptation to new and larger components (2) while the existing basic carrier (8) is maintained.

10056_____The different drives (12, 13, 26) of the adjusting means (9, 16, 17, 24, 25) and also the spindle drives (23) are connected to a control (34), which is shown schematically in Figure 1. It may be an independent control (34). As an alternative, the control may be integrated in an existing plant or station control or even in a robot control. The control is designed, e.g., as a numeric multi-axis control and may be, in particular, a robot control used for another purpose. In addition, the necessary operating material and energy supplies are present at the basic carrier (8).

10057_____The screwdriverdriver device (3) has, furthermore, a centering and lifting unit (27) arranged on the basic carrier (8). This [unit] comprises, e.g., four column-like frames, which are arranged at the corners of the carrier and extend upwardly in the direction of the z axis and have an introducing unit (28) with one or more oblique guiding surfaces at the upper free end. The introducing unit is connected to a lifting device (29) and can be raised and lowered in the direction of the z axis in a remote-controlled manner and optionally in cooperation with the control (34). The introducing units (28) mesh with the spindle frame (35) or alternatively with the components (2) and with a separate aggregate carrier. It is possible with the introducing unit (28), which is movable in height, to detach the spindle frame (35) or the components or component carriers from the initial position and from their conveyor and to position them opposite the screwdriverdriver device (3), and especially to center them. As a result, the necessary assignment is created in space between the screwingdriving tools (4, 5) and the corresponding screwingdriving points at the spindle extensions of the spindle frame (35) or at the components (2). Due to the adjusting means (24, 25), the screwingdriving heads (22) can then be extended from their withdrawn inoperative position and brought into the operating position and

meshed with the screwingdriving points. Oblique feed is also possible now by means of the pivoting adjusting means (25) or inclined bases (19) or brackets (18).

[0058]_____The individual screwingdriving tools (4, 5) can perform a plurality of screwingdriving operations during the screwingoperationmachine cycle and can be displaced in the process between the individual operations by means of the adjusting means (9, 16, 17) on the basic carrier (8) with a correspondingly accurate position control and suitable position transducers. The screwingdriving heads (22) can be equipped with suitable screwingdriving means in case of direct screwingdriving during the ancillary times when the components (2) are changed. The screwingdriving unit (3) may optionally also be moved laterally somewhat out of the screwingdriving station (1) for this.

[0059]_____The individual screwingdriving tools (4, 5) are preferably adapted to one another in height by corresponding bases (19) or the like such that an interference contour of essentially the same height is obtained with their upper ends or screwingdriving heads (22). The length of the brackets (18) and the height of the bases (19) is preferably selected to be such that a sufficiently large space is obtained for movement for workers ["Werke" in line 26, p. 16 is a typo for "Werker" - Tr.Ed.] under the components (2) in the screwingdriving station (1) when the screwdriverdriver device (3) is moved out of the screwingdriving station (1) in case of disturbance or for other reasons and there is a changeover to manual screwdriver operation.

[0060] Various modifications of the embodiments shown are possible. The different variants shown may be transposed or combined with one another as desired. This also applies to the individual design features of the different embodiment variants. The number and the arrangement of the screwingdriving tools (4, 5) and of the adjusting means (9, 16, 17, 24, 25) may vary as described. The kinematic assignment of the longitudinal and transverse adjusting means (16, 17) may be transposed, in which case the transverse adjusting means (17) is arranged on the basic carrier (8) and it carries the longitudinal adjusting means (16).

[0061] Mounting grids, e.g., screw hole grids, may be present on the plate- or frame-like subcarriers (14, 15) or on the carriers of the longitudinal and transverse adjusting means (16, 17). Furthermore, adapters may be present to change and adapt the positions of the screwingdriving tools (4, 5) to these mounting grids. The projection can also be changed and a screwingdriver tools (4, 5) can be arranged outside the carrier contour with adapters.

[0062] As an alternative, the centering and lifting unit (27) may be eliminated. Furthermore, design modifications of the assembly units described are possible.

[0063] The reference to a screwingdriving station (1) and a screwdriverdriver device (3) along with screwingdriving tools (4, 5) also comprises any other desired types of joining and assembly means and joining or assembly tools.

——**LIST OF REFERENCE NUMBERS**

- 1—Screwing station, assembly station
- 2—Component, body
- 3—Screwdriver device
- 5 4—Screwing tool
- 5—Screwing tool, pivotable
- 6—Screwdriver group
- 7—Screwdriver group
- 8—Basic carrier, plate
- 10 9—Adjusting means, multistep carriage unit
- 10—First carriage step
- 11—Second carriage step
- 12—First carriage drive
- 13—Second carriage drive
- 15 14—Subcarrier
- 15—Subcarrier
- 16—Adjusting means, one-step longitudinal adjusting means
- 17—Adjusting means, transverse adjusting means
- 18—Bracket
- 20 19—Base
- 20—Screwing unit
- 21—Screwing spindle

	22	Screwing head
	23	Spindle drive
	24	Adjusting means, height adjusting means
	25	Adjusting means, pivoting adjusting means
5	26	Adjusting drive
	27	Centering and lifting unit
	28	Introducing unit
	29	Lifting device
	30	Guide, rail
10	31	Underbody
	32	Adjusting guide, rail guide
	33	Adjusting guide, pivoting guide
	34	Control
	35	Spindle carrier, spindle frame

[0064] While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.